D-1 GEOTEXTILES

PURPOSE AND APPLICATIONS

Geotextiles (often called “filter fabrics”) are any permeable, synthetic, textile material used with foundation, soil, rock, earth, or any other geotechnical engineering-related material as an integral part of a man-made project, structure or system. The purpose of geotextiles is:

In separation, layers of different sizes of solid particles are separated from one another by the geotextile. Geotextiles are often placed underneath riprap to prevent underlying soil from eroding away.

In drainage, the geotextile allows water to pass and in the special case of drainage "transmission," the geotextile itself acts as a drain to transmit water through soils of low permeability. Geotextiles can be wrapped around perforated drainpipes to filter out fines that can clog them.

For reinforcement, the geotextile is used as a reinforcing element in the earth through either stress distribution or increase in soil modulus.

In filtration, the fabric acts similar to a two-dimensional sand filter, allowing water to move from the soil while retaining the soil.

CONSIDERATION

Proper material selection and installation is the key to success. Some products may look similar, but have very different characteristics. It is important to call the manufacturer or consult their literature when you have questions about which material to use or how to use it as there are many different types, grades of both woven and non-woven geotextiles.

Woven Geotextiles

The opening size of the fabric is critical when the geotextile serves as a filter for piping or if seepage gradients are significant. It provides a means of evaluating the retention characteristics of a geotextile and adequate resistance to clogging. To use a woven geotextile, the soil gradation must be known and ask the manufacturer for guidance concerning their fabric and proper selection.

Nonwoven Geotextiles

The size opening is not a critical property with nonwoven geotextiles as these geotextiles have a wide range of size openings. In general, nonwoven geotextiles retain more soil fines than do woven geotextiles. The structure of the mechanically bonded needle-punched fabric helps to decrease the internal fabric clogging potential. The nonwoven geotextiles have very good permeability characteristics and should be strongly considered where seepage flows are a concern. Nonwoven geotextiles have a rougher surface than wovens. Therefore, the bond between the soil and the geotextiles offer more resistance to sliding along the plane of contact.

SPECIFICATIONS

Design Criteria

The design for filtration requires retention of the soil while allowing sufficient flow through the textile and the prevention of clogging. Woven geotextiles require more critical evaluation and analysis than nonwovens in most applications.

Installation Specifications

Satisfactory performance of the selected geotextile is greatly dependent on the installation procedures and field preparation of the surface to be protected. When geotextiles are used adjacent to fill or backfill, the fill soils placement is critical in preventing conditions subject to plugging of the geotextile. The following techniques all minimize the movement of soil particles towards the geotextile surface and provide more area for flow through the geotextile.

- Prepare soil surfaces adjacent to geotextiles so that all flow channels or voids larger than the openings in the geotextile are eliminated.
- Utilize soil compaction and placement techniques to ensure that intimate contact between the geotextile and the soil is maintained.
- Provide a surface area as large as possible for the filter (i.e., it is better to place the geotextile around the periphery of the drain trench with gravel and pipe inside than to place the geotextile around the pipe where the surface area is smallest).

Slope Protection

Geotextile material is often used to prevent soil erosion beneath riprap armoring. Erosion can occur under and around ripped ditches, particularly if the side slopes are steep. Water flowing over the riprap can actually lift soil out from underneath the stones. This undercutting can be curtailed by using a geotextile layer between the riprap and the native soil. The geotextile covers the soil surface and protects it from erosion

The method of placement of rock or other material on the geotextile may have to be specified. Placement should be accomplished by equipment capable of controlling the drop. Pushing or rolling rock over the geotextile should not be allowed. The maximum drop is 3 feet for protected (6-inch sand or soil cushion for bedding) or unprotected geotextile. Where conditions require a larger drop, the strength of the geotextile and/or thickness of cushioning material needs to be increased.

To prevent movement of surface soil, where groundwater and seepage pressures are a factor, the geotextile must be kept in intimate contact with the soil. This is especially true on sloping surfaces where flow may occur beneath the geotextile. A sand layer bedding material may have to be specified to insure this contact in some cases. Gravel placed on the geotextile will hold it in place and minimize voids under the riprap. Embedment of the geotextile in a trench to form a cutoff at regular intervals down the slope will also help prevent riling beneath the geotextile. Cutoffs may have to be placed more closely spaced in highly erodible soils and spaced wider apart in more stable soils.

When a geotextile is used as a filter material replacement for the purpose of preventing particle migration, it is recommended that laps of adjacent geotextile panels require matching sewing or other positive joining methods. The method of joining laps should be specified on the drawings or in the construction details.

- Use non-woven geotextiles for this type of application because they are more permeable and they conform to the soil surface better.
- Anchor the upper ends of geotextile in a small trench to prevent it from slipping when the riprap is lain in the ditch.
- Overlap multiple sheets of geotextile by 1-2 feet (upslope fabric should overlap the downslope fabric, just like shingles on a roof).
- The soil surface should be relatively smooth and free of protruding rocks and debris that can puncture and tear the fabric.

Subsurface Drainage

Geotextiles can be used to improve subsurface drainage by removing groundwater from chronically soft, muddy sections of a road, a landscaped area or an embankment. Typically, this type of drain consists of a trench filled with gravel and/or perforated plastic pipe. The trench is designed to intercept the groundwater and drain it to a lower spot. Lining the trench with a geotextile prevents the pipe from clogging and extends the life of the drain. The geotextile also acts as a barrier between the gravel and surrounding soil, thereby preserving the permeability of the gravel.

- Lay the geotextile in the trench with the ends extending up over both sides of the trench. Once the trench has been filled with gravel, the ends can be folded over the top and then covered with soil.
- Overlap multiple sheets of geotextile by at least 1-2 feet.

- Make sure the drain has a continual downhill pitch and discharges into a stable area.
- See that the soil surface is free from rocks or other protrusions to ensure good contact between the soil and the geotextile.

Use manufacturers recommended normal condition non-woven geotextiles where material will not be dropped more than five (5) feet onto the geotextile, where trench depths will be no deeper than ten (10) feet from the normal ground surface and sharp, angular aggregates are not used.

Heavier geotextiles are recommended when trench depths of greater than ten (10) feet or sharp, angular aggregates are used. The tensile strength should be no less than 150 pounds and burst strength no less than 300 psi.

To prevent rock movement to surface soil, where groundwater and seepage pressures are a factor, the geotextile must be in intimate contact with the subgrade soil. Voids between the geotextile and the base soil need to be minimized to prevent the collecting of fines behind the geotextile and subsequent clogging. The geotextile should be pulled flat during installation to eliminate wrinkles and folds that create voids.

If flow in the plane of the geotextile is a concern in the drain installation, the thickness of the geotextile becomes an important criterion. A heavier weight nonwoven needle punched fabric should be used.

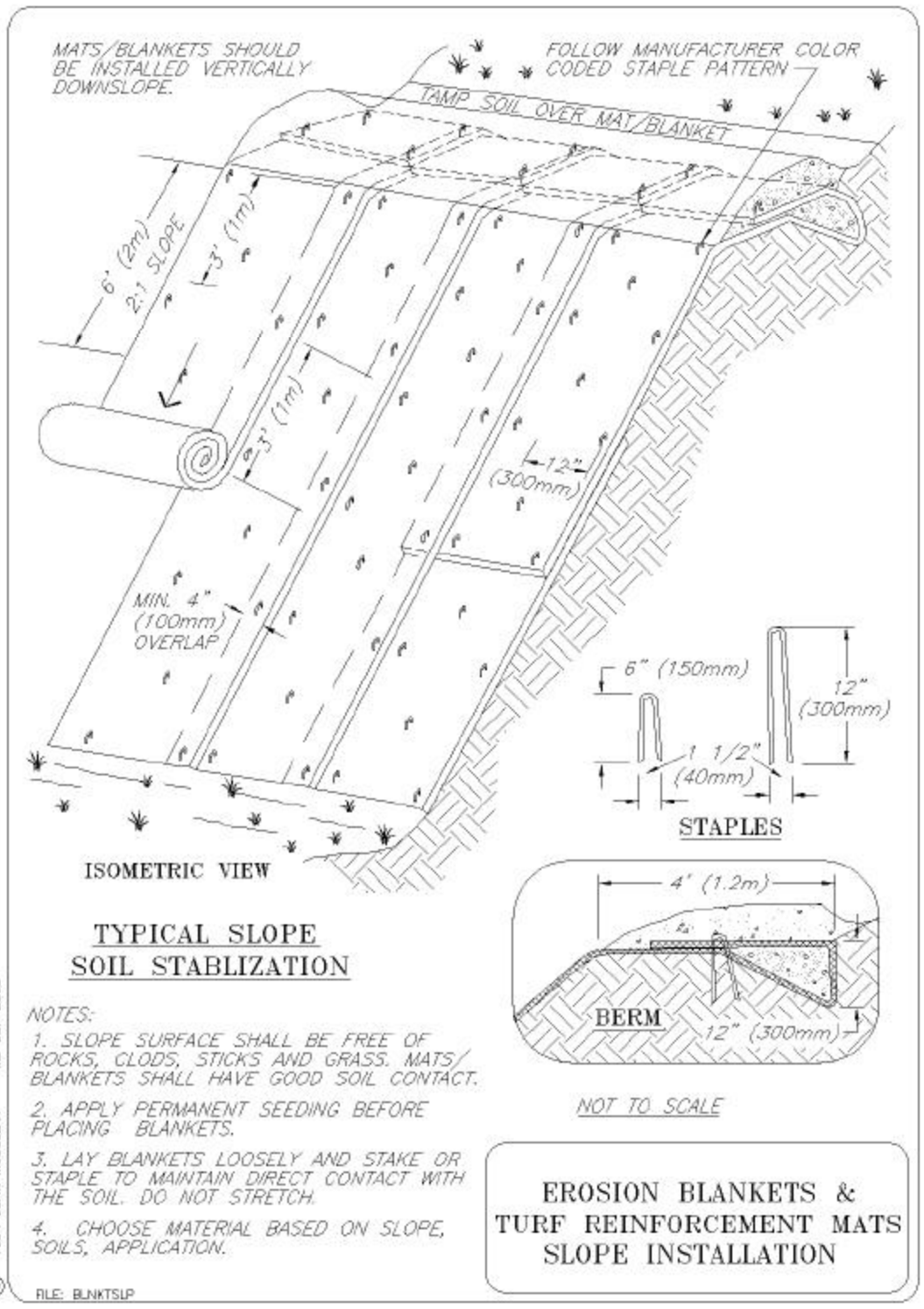
Road Stabilization

Stabilization is a way to firm up soft roads that are prone to tire rutting. This situation results from a road base or subgrade that is poorly drained. The first step is to grade and crown the existing road surface. Then, roll out the geotextile fabric over the full road width, covering the entire problem area. The final step is to cover the geotextile with at least 10-12 inches of good road gravel. Using geotextile will enhance the road stability by dispersing the vehicle weight over a broader area preserving the integrity of the good gravel over the poor soils beneath it.

- Use woven geotextiles for stabilization because of their superior strength. Some heavier weight, non-woven types may suffice. Check with the product manufacturer for their recommendations for light to medium loading in both weight and frequency or traffic.
- Always overlap sheets of geotextile by as much as 2-3 feet. If the subgrade is soft and it is determined that the potential for rutting is high, the overlap should be increased
- Remove protruding rocks and other debris from the road before putting down geotextile to prevent punctures and tears.

MAINTENANCE

If any sign of damage is apparent, geotextiles must be repaired or replaced as needed to maintain their performance.


MATS/BLANKETS SHOULD BE INSTALLED VERTICALLY DOWNSLOPE.
FOLLOW MANUFACTURER COLOR CODED STAPLE PATTERN
TAMP SOIL OVER MAT/BLANKET
6' (2m)
2:1 SLOPE
3' (1m)
3' (1m)
12" (300mm)
MIN. 4" (100mm) OVERLAP
ISOMETRIC VIEW
6" (150mm)
12" (300mm)
1 1/2" (40mm)
STAPLES
4' (1.2m)
BERM
12" (300mm)
NOT TO SCALE
TYPICAL SLOPE
SOIL STABLIZATION
NOTES:
1. SLOPE SURFACE SHALL BE FREE OF ROCKS, CLODS, STICKS AND GRASS. MATS/ BLANKETS SHALL HAVE GOOD SOIL CONTACT.
2. APPLY PERMANENT SEEDING BEFORE PLACING BLANKETS.
3. LAY BLANKETS LOOSELY AND STAKE OR STAPLE TO MAINTAIN DIRECT CONTACT WITH THE SOIL. DO NOT STRETCH.
4. CHOOSE MATERIAL BASED ON SLOPE, SOILS, APPLICATION.
EROSION BLANKETS & TURF REINFORCEMENT MATS SLOPE INSTALLATION
1994 JOHN McCULLAH ME DEP 2003
FILE: BLNKTSLP